

ROLE OF QUANTITATIVE NON CONTRAST COMPUTED TOMOGRAPHY EVALUATION IN ACUTE CEREBRAL VENOUS THROMBOSIS

Mohamed Abdel Kader El-Deeb, Ahmed Mohamed Abougabal, Gehad Wagieh Abdelfatah Ahmed

Department of Radiodiagnosis and intervention, Faculty of Medicine, Alexandria University, Alexandria, Egypt.

Introduction

Cerebral venous thrombosis (CVT) is an uncommon type of venous thromboembolism that primarily affects young adults and children. CVT has three subtypes that frequently coexist: cortical vein thrombosis, deep cerebral vein thrombosis, and cerebral venous sinus thrombosis. Females are affected three times more frequently than males due to gender-related risk factors such as oral contraceptives and pregnancy. CVT has a wide range of nonspecific clinical manifestations, from headache to coma. Prompt evaluation is required because early anticoagulation can reverse acute CVT and reduce complications. CVT can be diagnosed using either an MRI with MR venography (MRV), CT venography (CTV), or catheter angiography. A filling defect is noted within the thrombosed cerebral vein or dural sinus on CTV or MRV. An acute venous thrombus can appear as a spontaneous hyperattenuation on a non-contrast CT (NCCT). The addition of venous attenuation measurement to the NCCT may improve its diagnostic value.

Aim of the work

This study was conducted to assess the role of quantitative non contrast computed tomography evaluation in acute cerebral venous thrombosis.

Patients and Methods

This study included two groups: a case group of 30 patients with acute CVT and a control group of 10 normal patients. Each patient underwent brain imaging, including NCCT and MRV or CTV. In the case group, the site of thrombus was identified from the MRV or CTV, and the mean attenuation in Hounsfield units (HU) in the NCCT was measured. In the control group, the mean attenuation of the normal cerebral venous sinus that could be differentiated from the brain parenchyma in the NCCT was measured. In both groups, the mean attenuation of both intracranial portions of the internal carotid arteries as they exit the carotid canal was measured. Because the mean venous attenuation may vary depending on the hematocrit (Hct) level, standardisation was attempted by dividing the value of the mean venous HU (HUv) by the Hct level (HU:Hct ratio) or by the mean arterial HU (HUv:HUA ratio).

Results

The results showed that there was a statistically significant difference in the attenuation value, HUv:Hct and HUv:HUA ratios between cases and controls ($P < 0.0001$). In our results, no overlap was found between the case group and the control group, which yielded an AUC of 1.

The mean venous attenuation in the case group was 72, while it was 48.7 in the control group, and the proposed cut off value is 66. The mean HUv:Hct ratio in the case group was 2.15, while it was 1.28 in the control group, and the proposed cut off value is 1.75. In the case group, the mean HUv:HUA ratio was 1.88, while in the control group, it was 1.11, with a proposed cut off value of 1.43.

Table (1): Comparison between the two studied groups according to HUv

HUv	Case (n=30)	Control (n=10)	p
Min. – Max.	66 – 80	41 – 56	<0.001*
Mean ± SD.	72.13 ± 4.74	48.7 ± 4.85	

Table (2): Comparison between the two studied groups according to HUv:Hct ratio

HUv:Hct ratio	Cases (n=30)	Control (n=10)	p
Min. – Max.	1.75 – 3.36	1.15 – 1.40	<0.001*
Mean ± SD.	2.15 ± 0.35	1.28 ± 0.09	

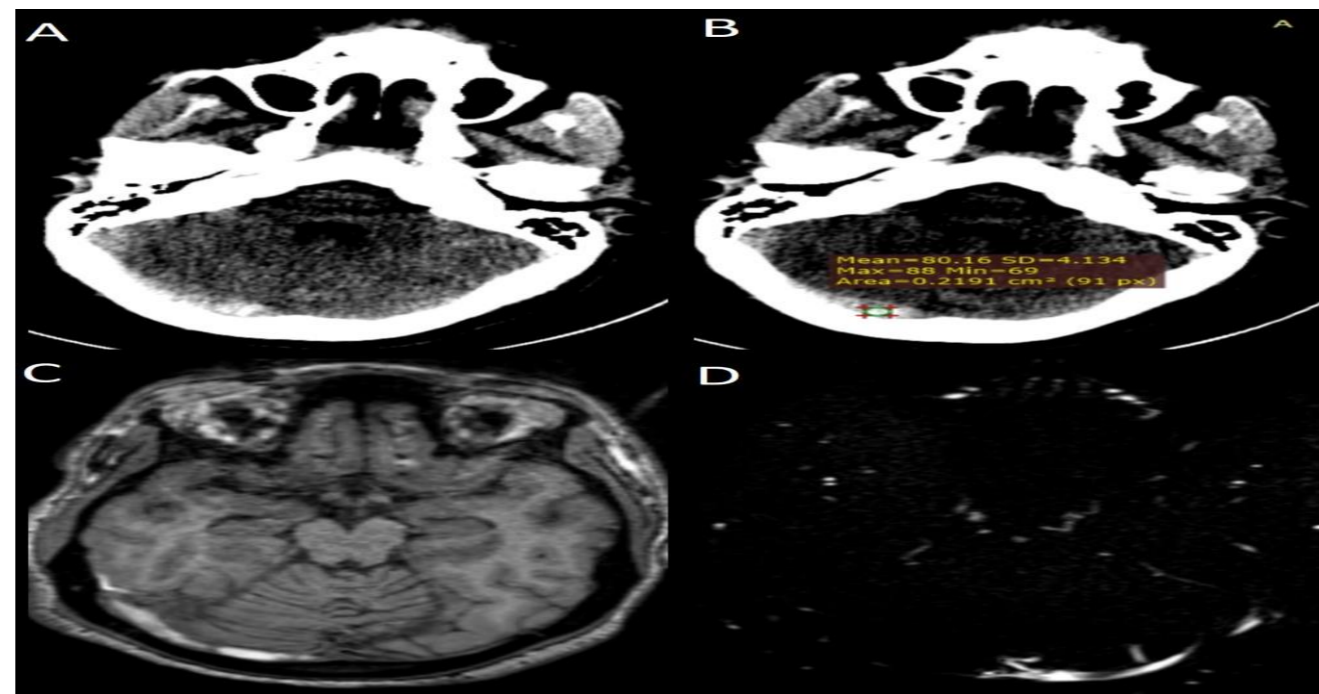


Figure 1: A 20-year-old female patient presented with a three-day history of right upper limb numbness and convulsions. She has been postpartum for 8 days. Imaging revealed right transverse sinus thrombosis. Axial NCCT brain (A) showed hyperdensity of the right transverse sinus. The mean attenuation value of the right transverse sinus was 80 HU (B), suggesting acute right transverse sinus thrombosis. Axial T1 (C) showed loss of signal void of the right transverse sinus. 2D TOF MRV (D) showed a filling defect of the right transverse sinus, confirming the thrombosis.

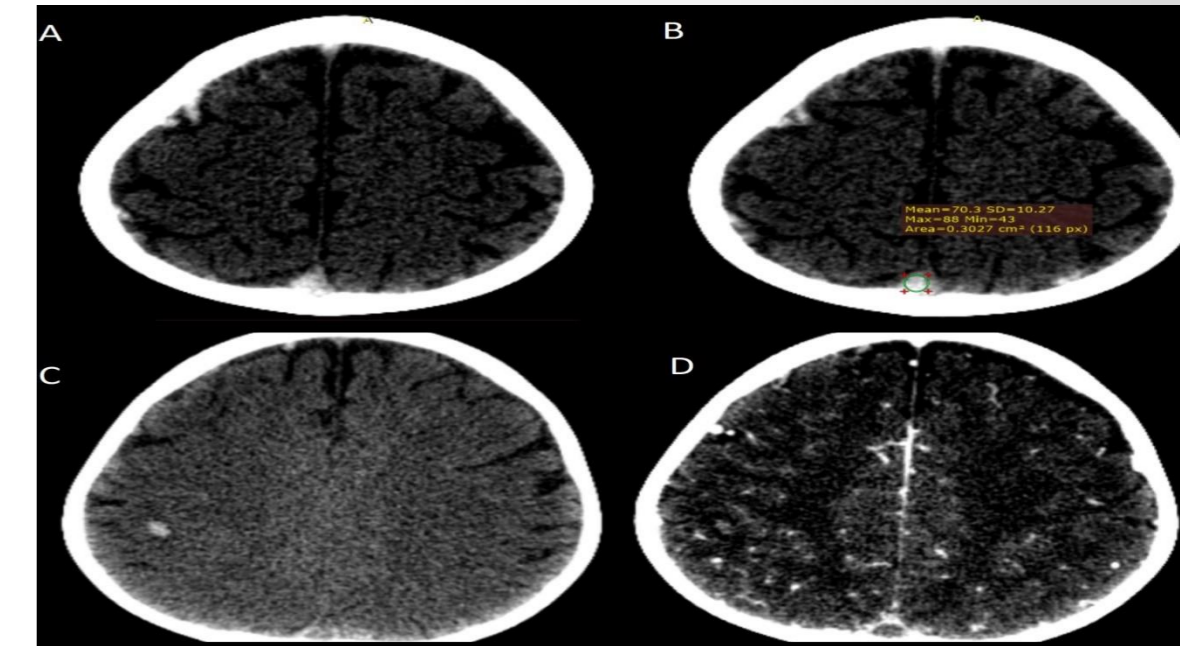


Figure 2: A 6-year-old male leukemic patient on chemotherapy came with a one-day history of headache, dizziness, and convulsions. Axial NCCT brain (A) showed hyperdensity of the superior sagittal sinus and several cortical veins, suggesting acute CVT. Axial NCCT (B) showed region of interest (ROI) placement within the posterior aspect of the superior sagittal sinus. The mean attenuation value of the superior sagittal sinus was 70 HU. Axial NCCT brain (C) showed a right parietal hemorrhagic infarction. Axial CTV (D) showed a filling defect of the SSS with an empty delta sign, confirming the thrombosis.

Conclusion

Quantitative non-contrast CT (NCCT) evaluation may add another tool to the radiologist's toolbox for improving the diagnostic performance of NCCT in the early detection of acute cerebral venous thrombosis (CVT) and guiding further imaging and management. Patients with symptom onset within seven days and an NCCT scan that shows a suspicious appearance of a cerebral venous structure (such as hyperattenuation) with an attenuation cutoff of 66 HU, a HU:Hct ratio cutoff of 1.8 or a HUv:HUA ratio cutoff of 1.43 are more likely to have acute CVT and require additional investigations to rule out the possibility of venous thrombosis. However, further studies with a larger number of patients are required to validate these cutoffs.